

## Activity #1 – Why are there no active fire detections for areas where fire activity is likely or anticipated?

Background: The ability to detect fire activity via satellite is affected by several technical and environmental factors. See the FIRMS FAQ [“Why was a particular fire not detected?”](#) for details.

- Use FIRMS US/Canada (with ADVANCED MODE / Custom selected in the FIRMS map legend on the right) to view VIIRS 375m NOAA-20 and Suomi NPP wildland fire activity displayed on VIIRS S-NPP Corrected Reflectance imagery for May 27, 2023. Using the Location Tool, type the following lat/long (59.4239, -120.0284) into the Find Location and, once located, zoom out until Northwest Alberta, Northeast British Columbia and the Southern Northwest Territories are displayed. Click [here](#) for a shared FIRMS map.
  - In the FIRMS map legend on the right, display only the fire activity detected by VIIRS NOAA-20 during the daytime overpasses for May 27, 2023. Do this by unchecking all the Fires/Hotspots layers (Landsat, VIIRS / Suomi NPP, MODIS / Aqua and MODIS / Terra) excepts VIIRS / NOAA-20, then selecting the “+” button next to VIIRS / NOAA-20, and turning off the detections acquired on the nighttime observations by clicking the “Night” button.
  - Note the large number of fire detections observed by NOAA-20 VIIRS for the four large fires in the center of the map view (Lat: 59.4239, Lon: -120.0284). *User Tip: Close the Location Tool, and then use the cursor and click on individual fire detections to view their attributes.*
  - Also note the large size of these fires. They range from 70,000 to 200,000 hectares in size (*User Tip: Use the Measure tool (located at the bottom of the map interface in the center) to estimate the Area of the large to wildfires in the map extent*).
- Use the Timeline (*located at the bottom of the map interface*) to advance the date to May 28 (the imagery and fire detection data will automatically update for the selected date).
  - Note the detected fire activity for all four fires on May 28th compared to May 27<sup>th</sup>. Use the timeline to alternate back and forth between the two dates compare.
- Use the Timeline on the FIRMS map interface to advance the date to May 29<sup>th</sup>.
  - Note the detected fire activity for all four fires on May 29<sup>th</sup> compared to the May 27<sup>th</sup> and May 28<sup>th</sup> (*User Tip: Use the timeline to click and alternate back and forth between the three dates to compare*).
- Use the timeline on the FIRMS map interface to advance the date to May 30<sup>th</sup>.
  - Note the detected fire activity for all four fires on May 30<sup>th</sup> compared to the May 27<sup>th</sup>, May 28<sup>th</sup> and May 29<sup>th</sup>.
- Question(s)
  - Why does the detected fire activity over these multiple days vary?
  - Is the amount of fire activity for each of the fires changing from day to day or is the ability of the satellites to view/detect fire activity affected?

- What else could affect the ability of satellites to detect fire activity? (*User Tip: Refer to the referenced FIRMS FAQ above for help*).
- What can possibly be done to work around this limitation?

## Activity #2 – Understanding Band Combinations and Spatial Resolution of Different Sources of Imagery in FIRMS

Background: In addition to viewing fire activity, smoke, etc., multispectral satellite imagery can be manipulated to enhance and display particular features.

- In FIRMS US/Canada, use the Location Tool and Find Location tab to zoom into the area of Michigan Bluff, California (lat, lon: 39.0418, -120.7365). This area experienced a 31,500 hectare wildfire, called the Mosquito Fire, in late summer 2022. Use the Timeline (*located at the bottom of the map interface*) to set the date to Sep 25, 2022, and, using the FIRMS map legend on the right, select different satellite imagery from the multiple sources under Dynamic Imagery. Click [here](#) for a shared FIRMS map. to view satellite imagery from multiple sources for the area of Michigan Bluff, California Click [here](#) for a shared FIRMS map.
  - The map is centered on the burned area and displays Aqua MODIS true color composite imagery acquired on September 25, 2022. A “true color composite” means the visible light bands of the MODIS imagery (red, green and blue) are presented in the corresponding red, green and blue color channels of the display. This results in a natural color image that represents the Earth’s surface as it would appear to the human eye.
  - The visible light bands of MODIS are acquired at a spatial resolution of 250 meters or 500 meters, which is relatively coarse. At this spatial resolution, it makes it difficult to distinguish details of the landscape. Also, due to the combustion of vegetation, residual ash, exposed soil, etc., burned areas will appear dark gray in the visible part of the spectrum. Consequently, in a true color composite image, burned areas can be difficult to distinguish from the surrounding healthy, dense vegetation cover (forests, etc.) that appear dark green.
- Now let’s view the burned area as a false color composite image to enhance its the visibility. In the FIRMS map legend on the right, toggle on for display the “MODIS/Aqua Corrected Reflectance 721” layer at the bottom of the “Dynamic Imagery” group in the “Dynamic Imagery” group in the legend.
  - In this composite, the MODIS shortwave infrared band (band 7), near infrared band (band 2) and red band (band 1) correspond to the red, green and blue display channels. Shortwave infrared radiation is strongly absorbed by open water and moisture in vegetation and is strongly reflected in exposed, rocky and dry soils. Inversely, near infrared energy is reflected strongly by healthy vegetation and is mainly absorbed by the bare ground. Burned areas appear dark brown or reddish-brown and healthy vegetated areas appear bright green in this particular composite. Although the burned area is now more apparent, the spatial resolution of these bands is still relatively coarse and does not present a refined image. (*User Tip: selecting the “i” symbol next to each layer*)

*provides information about that layer including, for example, Temporal Coverage, relevant References, etc.)*

- Next, we'll view the burned area using higher spatial resolution imagery. In the FIRMS map legend on the right, locate the "Harmonized Landsat / Sentinel-2 Imagery" group, select the "+" to open the group, and toggle on for display the "(beta) Landsat Adjusted Reflectance HLS L30 (bands 7-5-4) [good for burned area]" (*User Tip: Imagery in the "Harmonized Landsat / Sentinel-2 Imagery" group, are dynamically generated and can take time to load*)
- Landsat and Sentinel-2 imagery are the highest spatial resolution imagery available in FIRMS and made available through the Harmonized Landsat Sentinel-2 (HLS) project. The imagery is available as true and false color composites, similar to the MODIS and VIIRS imagery. Although collected at much higher spatial resolution, this imagery is acquired less frequently (every 8 days for Landsat and every 4-5 days for Sentinel-2).
- The 30-meter false color composite Landsat image renders the burned area at much higher spatial resolution and with more detail than the much coarser MODIS or VIIRS imagery.
- Using the Location Tool, type the following lat/long (38.6853, -120.3196) into the Find Location tab to recenter the display, or click with the cursor and pan approximately 50KM southeast of the Mosquito Fire. The east-west trending burned area you now see is the 90,000 hectare Caldor Fire which occurred in 2021.
- Question(s)
  - Can you see evidence of other recent and older occurrences of disturbance in the areas around the Mosquito and Caldor fires in the Landsat false color composite? Particularly in the area between the two burned areas and to the east of the Mosquito Fire area? See this [shared FIRMS map](#) for and this [Wikipedia entry](#) for details.
  - Can you see differences in the Landsat false color composite for the 2021 Caldor fire, which has had one year to recover since it burned, compared to the 2022 Mosquito fire?
  - How do conditions in the Caldor and Mosquito fire areas in the 2022 Landsat false color composite imagery compare to the King Fire which occurred 8-9 year earlier?